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FARMERS' BULLETIN 400.

A MORE PROFITABLE CORN-PLANTING METHOD.

BY

C. P. HARTLEY,
Physiologist in Charge of Corn Investigations,
Bureau of Plant Industry.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., April 1, 1910.

SIR: I have the honor to transmit herewith, and to recommend for publication as a Farmers' Bulletin, a manuscript entitled "A More Profitable Corn-Planting Method," by C. P. Hartley, Physiologist in Charge of Corn Investigations.

Studies of the habits of growth both below and above ground of this our most valuable and widely grown plant have for several years indicated that fields of checked corn, comprising about half of the total corn acreage, yield less than they would if the kernels were not crowded so closely together in the hills.

As this assumption has now been substantiated, the farmers should be informed on the subject and advised to substitute, as soon as possible, some method of checking that will give every stalk in their cornfields a fair chance to thrive and produce abundantly.

Respectfully,

G. H. POWELL,
Acting Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.

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A MORE PROFITABLE CORN-PLANTING METHOD.

INTRODUCTION.

Much study has been given to corn-planting methods and much progress made. This progress has usually been along the line of more rapid and easier planting and cultivating. While retaining these advantages, the method here described causes higher yields by supplying each plant with better conditions for growth and production.

METHODS BY WHICH MOST CORN IS PLANTED.

Single-row corn planters drawn by one horse—or two-row planters drawn by two horses—are used in planting the greater part of the corn grown in the United States. All these planters deposit the kernels of hill-planted corn together in a small space, or bunch, resulting in the stunting of many plants because of insufficient space to form a strong root system or vigorous stalk and leaves. Many prevent this stunting by drilling their corn. Drilled corn is planted in rows, one kernel in a place. Checked corn is planted in hills that permit cultivation both ways.

Which is the most profitable, drilling or checking, is a much debated question. On hilly land, where the soil washes readily, checking is not practicable. Where both methods are practicable one method has about as many advantages and disadvantages as the other, and corn producers are practicing the two methods to about the same extent.

THE ADVANTAGE OF DRILLING.

Standing singly, as in drilled corn, each plant has a fairer chance both below ground and above ground to develop normally and produce well.

It requires a little less care to drill than to check, though in fields free from trees the difference is very slight after the operator has become accustomed to the use of the checking wire which is stretched across the field.

THE ADVANTAGE OF CHECKING.

Checking enables the corn to be cross-cultivated and kept free from weeds and the entire soil surface kept in good condition without the expensive labor of hoeing.

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DOUBLE ADVANTAGES OF KERNEL-SPACED CHECKING.

"Kernel-spaced checking" is the term used to designate the more profitable method described in this bulletin. It largely overcomes the disadvantages and combines the advantages of the two methods now used in planting most of the corn grown in the United States.

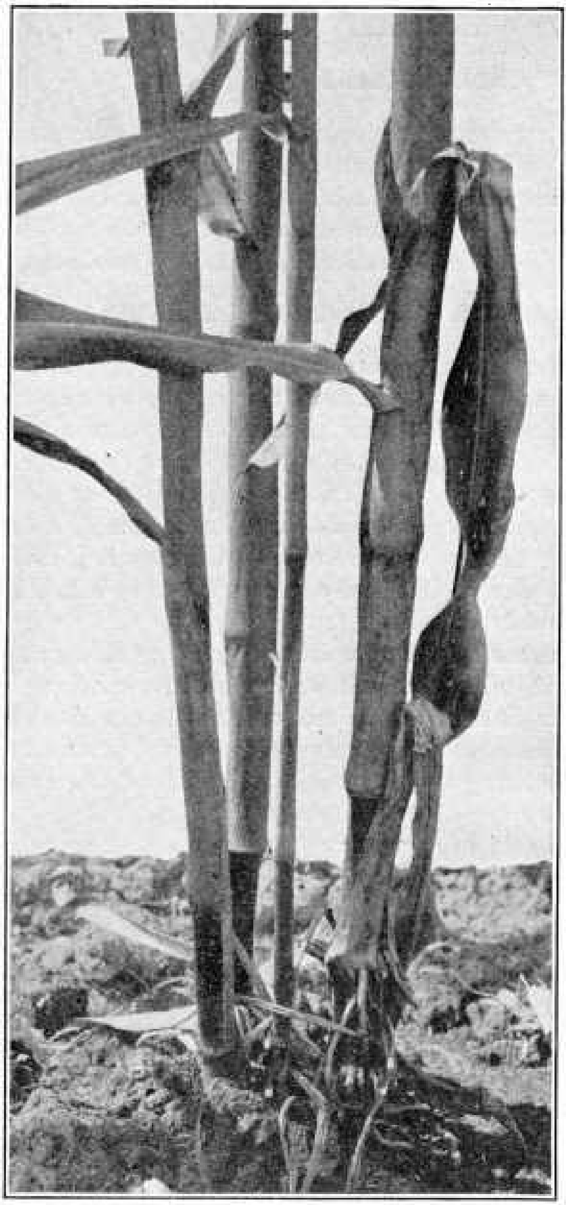

FIG. 1.—Hill of corn planted by a modern check-rower. The central stalk had no chance to develop, either below or above ground, and produced but a nubbin.

The double advantages of kernel-spaced checking became apparent several years ago in connection with tests of thick planting on very fertile river-bottom soil. On this soil one stalk to every 12 inches of row, when hoed, was found to give higher yields than checked corn with either three or four stalks in every hill.

Drilling, however, was not practicable because of the abundant growth of weeds. Planting four stalks in each hill with a check-rower was found to result in an unusually large percentage of nubbins and stunted and barren stalks. Drilled corn with the same number of stalks to the acre gave larger yields with fewer nubbins and stunted and barren stalks, but could not be well cultivated without expensive hoeing.

It was thought that kernel-spaced checking would be found profitable on soil sufficiently well supplied with moisture and fertility to permit four or five stalks to the hill. This has been found to be the case. Furthermore, it has been found profitable on dry soils of medium fertility.

In all fields of corn planted with our most modern check-rowers can be found many hills containing a stalk that has not produced

FIG. 2.—Base of a corn plant at silking time. For a foothold each plant needs a cubic foot of space.

well. In many such cases the stunting is due to the quicker starting or better location of the other plants, which enabled them to monopolize the space, moisture, fertility, and sunlight of the limited area in which the kernels were planted. (See fig. 1.)

With roots and stalks limited to so small a space, plants from any cause once obtaining a monopoly easily retain it. This plausible idea is substantiated by the tests described later, which produced

more stunted and barren stalks and more nubbins in rows of ordinary checking than in adjacent rows of kernel-spaced checking.

Such stunting, because of the nature of the corn plant, materially reduces the grain yield. Plants that are crowded to such an extent that they become slender and scarcely more than half their normal height are either barren or produce only nubbins.

WHY KERNEL-SPACED CHECKING SHOULD GIVE INCREASED YIELDS.

The disadvantage under which the two or more plants of a hill are compelled to grow by the kernels having been bunched together is so plain that it is remarkable we have not long ago devised a method of checking corn that gives each plant room to form a normal root system.

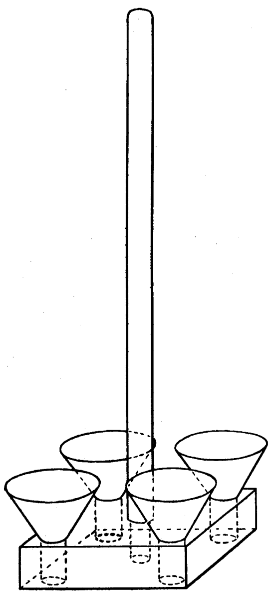

FIG. 3.—The device used in dropping corn by hand in the kernel-spaced rows of the tests.

For a distance of 6 inches in every direction from the base of a normal corn plant the soil is crowded entirely full of roots. When several kernels are bunched together the roots of all the stalks of the hill are so matted together that the pulling of one stalk pulls out the entire hill, and the pressure of wind upon all the stalks is more likely to blow over the entire hill than when the stalks stand several inches apart in the hill, thus forming a broader base of support. Figure 2 shows the base of one corn plant at silking time, the critical period, when all the roots should be well located for supplying moisture to the plant. The three stalks of a hill grow at a great disadvantage with no more foothold in the soil than one plant requires.

KERNEL-SPACED CHECKING TESTED IN COMPARISON WITH THE USUAL METHOD.

The following-described tests were especially planned to decide whether the kernel spacing of checked corn would increase the yield above that obtained by the generally practiced method of checking. Eight alternating rows of kernel-spaced and of ordinary checking were planted in three different localities on different types of soil. In order to test the practicability of cultivating the kernel-spaced checking, the test rows were placed in the center of fields of checked corn and were without difficulty cultivated both ways when the fields were cultivated.

The device used for space planting is shown in figure 3. Two kernels were planted at each corner of a 5-inch square. Each space-

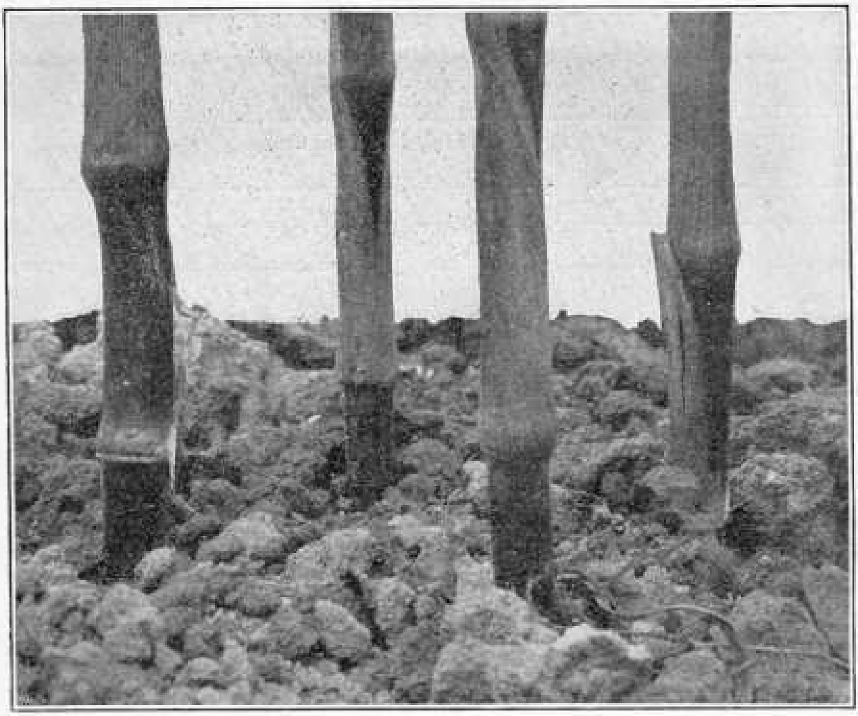

FIG. 4.—A hill of the kernel-spaced rows of the tests. The stalks stand at the corners of a 5-inch square. (Photographed before the formation of brace roots at the lower nodes.)

planted row was followed by a row treated in all respects the same except that the kernels were not so well separated, being deposited as a check-rower would deposit them and with six kernels to the hill.

When the corn was a foot tall, all the rows were thinned to a uniform stand. Four stalks to the hill were retained wherever possible. When about ready to tassel several more stalks were removed from some of the rows to bring adjacent rows to exactly the same number of stalks.

Figures 4 and 5 show the differences in appearance due to the different methods of

FIG. 5.—A hill of the rows tested in alternation with the kernel-spaced rows. These hills were bunched to no greater extent than is done by the modern check-rower. (See fig. 1.)

planting. Figure 4 shows a typical hill from the space-planted rows, while figure 5 is typical of the usual method of checking. The difference in the uniformity of the stalks is very marked.

TABLE I.—*Comparative yields of corn when kernel-spaced checking and the usual method of checking were employed.*

	Tests at Round Hill, Va.	Tests at Piketon, Ohio.	Tests at McLean, Va.
Character of the summer	Very dry	Very favorable	Very dry.
Nature of the soil.	Stony clay loam.	River-bottom deposit.	Heavy clay loam.
Distances between corn hills	3¾ by 3⅓ feet.	3⅓ by 3¼ feet	3¾ by 3½ feet.
Height of the varieties tested	Tall	Very tall	Medium.
Average number of stalks to the hill.	3	3¾	3⅘.
Number of stalks to the acre	10,500	15,100	12,700.
Stalk circumference increased by spacing.	14½ per cent.	7 per cent	13 per cent.
Number of poor ears produced:			
Kernel-spaced method	498	447	652.
Usual method	584	502	712.
Yield per acre:			
Kernel-spaced method	55 bushels	118½ bushels	64 bushels.
Usual method	53 bushels	114 bushels	61 bushels.
Gain to the acre by spacing the kernels.	2 bushels	4½ bushels	3 bushels.
Number of adjacent-row tests	7	9	9.
Number of times in which adjacent-row tests produced equally.	0	1	1.
Number of tests in which kernel spacing increased the yields.	4	7	8.
Increase obtained by spacing the kernels.	3¾ per cent	4 per cent	5 per cent.

KERNEL-SPACED CHECKING YIELDS BETTER IN EVERY CASE.

Under the different conditions of climate and soil and with different varieties of corn, each test has shown that kernel spacing of checked corn increases the yield. The kernels were placed only 5 inches apart in the hills. A distance of 8 or 10 inches may increase the yield still more, and such hills can be readily cultivated both ways provided the checking is accurately done. Check-rowers can be manufactured with two shoes for each corn row and a separate dropping tube for each kernel of a hill. They can be made adjustable, so that the number of kernels dropped and the spacing distances between the kernels of a hill can be suited to the fertility of the soil and the variety of corn planted.

Proper distances for spacing the kernels within the hill will have to be determined for large and small growing varieties. The three varieties tested ranged from medium to very tall, each being adapted to the locality in which it was tested. All produced better by spacing the kernels of each hill 5 inches apart than by the customary method of dropping them close together in the hill.

In addition to the 25 tests of rows growing side by side in which one row was kernel-spaced and the adjacent row checked by the usual method, there were at each locality two adjacent plats, one kernel-spaced checked and the other checked by the usual method. At two of the localities the yield of the kernel-spaced plats exceeded that of those planted by the usual method to about the same extent as in the alternate-row tests. At McLean, Va., the plats produced equally well, but the alternate-row plantings gave an increase of 11 per cent in yield due to kernel spacing, bringing the average increase for the two methods of testing to practically 5 per cent, as given in the table.

THE INCREASED YIELD IS NET GAIN.

Two bushels more to the acre, or a 4 per cent increase, is not small enough to be ignored, especially when obtainable without cost except the initial cost of a kernel-spacing check-rower.

Increased yields resulting from applications of expensive fertilizers sometimes fail to increase the profit on the crop. The increased yield due to spacing the kernels is clear gain, since a properly constructed check-rower can drop the seed in separate places as rapidly and as cheaply as the present check-rower bunches them.

In planting 50 acres of corn such a check-rower would pay for itself the first year. In planting 100 acres, estimating the production at the average of 26 bushels, it would return a net profit of 104 bushels.

A 4 per cent increase in the value of the corn crop of Illinois for one year would amount to $6,000,000. About one-half of the corn acreage of the United States is checked or planted with planters that drop all the kernels of a hill in a bunch. The substitution of kernel-spacing planters would add 50,000,000 bushels of corn to our annual production.

KERNEL-SPACED CHECKING PERMITS CULTIVATION WITHOUT DIFFICULTY.

The 5-inch spacing of the kernels in each hill did not make it difficult to properly cultivate in both directions with 2-horse double cultivators, although in one instance the rows were but 3⅓ feet apart in one direction and 3¼ feet in the other. Three-horse 2-row cultivators could have been used to as good advantage as in the usual method of checking. If the kernels in each hill are spaced 6 or 8 inches apart, the gangs of shovels on the cultivator will need to be set farther apart in order to properly straddle the hills. A spacing wider than 8 inches may allow weeds to grow in the corn hills. In this respect the 5-inch kernel spacing gave no greater growth of weeds and received no more work than the ordinary checking.

OTHER ADVANTAGES OF KERNEL SPACING.

Increased yield without extra cost is abundant reason to cause a change of methods. A few other advantages of kernel spacing may be mentioned. It is easier to thin kernel-spaced hills, and the thinning can be done without injury to the remaining stalks.

When the plants stand separately in the hills, an entire hill is less liable to be pulled out by the harrow, the weeder, or the cultivator. The entire hill is not so likely to be injured by accident, disease, cutworms, or corn-root insects. The better distribution not only affords each stalk better sunlight, but also shades the soil better, thereby lessening evaporation from the heated soil during the summer months.

At McLean, Va., the rows checked by the usual method blew down at tasseling time to a much greater extent than the adjacent kernel-spaced rows. At Piketon, Ohio, the kernel-spaced rows were noticed at harvest time to have fewer down hills than the adjacent bunch-planted rows. The kernel-spaced stalks appeared stronger and measurements proved them to be at each locality of greater circumference than the bunch-planted stalks. (See Table I.)

PRESENT APPLICATION OF THE ADVANTAGES.

Until kernel-spacing check-rowers are placed upon the market farmers can utilize this method extensively only by remodeling their check-rowers or by double driving. By returning across the field with the check-rower, without resetting the wire, and driving 6 inches from the previous track, each hill can be made up of two bunches of kernels. This will improve somewhat the distribution of the plants in the hills, but will not be as good as a check-rower with four or more dropping tubes for each corn row.

By double driving, as just mentioned, with planters set to drop one kernel at a time, each stalk will be given room to form a good root system. Drilled corn planted by this method won the Iowa sweepstakes prize in 1909 by producing 153 bushels of shelled corn on 1 acre.[a]

PROFIT DEPENDS MAINLY ON LARGE YIELDS TO THE ACRE.

Increasing population and increasing value of land are sure to stop the long-continued practice of planting corn thinner as the land becomes poorer, making up the supply by planting more acres. Our future increase in corn production must be accomplished mainly by filling the soil with water-absorbing and water-holding humus, accompanied by thicker planting. This practice has produced 239 bushels of shelled corn on an acre in South Carolina,[b] and 226 bushels on an acre in North Carolina.[c]

Soils are not impoverished by producing large crops. On the contrary, the larger the crops and the more frequently they are produced the better the opportunity to enrich the soil by plowing under a sufficient portion of the vegetable matter produced. The soil should be kept busy enriching itself through the decay of vegetation, as forest lands enrich themselves. To most soils one or more mineral elements must eventually be applied to replace those which are removed from the farm in the form of grain or animal products.

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[a] See Farmers' Tribune, February 3, 1910. John Sundberg, of Monona County, Iowa, won this prize in accordance with the rules of the Iowa Corn Growers' Association. The planter was driven the second time several inches from its previous track, giving a double row of plants. Adjusted to drop one kernel every 16 inches the planter driven in this manner planted 20,633 kernels to the acre. The acre had been a clover pasture for five years and was fall-plowed. No manure or commercial fertilizer was used.

[b] See C. S. Plumb's book on Indian Corn Culture, 1895, p. 220. The rows were alternately 3 and 6 feet apart, and 5 or 6 kernels were dropped to each foot of the row, 1,000 bushels of stable manure, 600 bushels of cotton seed, and $50 worth of commercial fertilizer being applied to the acre.

[c] See Wake County Corn Experiments of 1909, by F. A. Olds, secretary, Chamber of Commerce, Raleigh, N. C. The first prize was won by J. F. Batts, of Garner, N. C. The rows were 41 inches apart, and 3 kernels were planted in hills 8 inches apart in the row, 19,000 stalks being grown on 1 acre. Forty-five 2-horse loads of manure and $59 worth of commercial fertilizer were applied to the acre.

SUMMARY.

In planting corn in hills practically all corn planters drop all the kernels of the hill in a bunch.

A study of the best conditions for growth and production indicates that bunch planting results in unnecessary crowding both above and below the ground, weakening the stalks and reducing the yield.

Kernel-spaced checking combines the advantages and overcomes the disadvantages of drilling and checking, the two methods by which nearly all corn is now planted.

Tests with three varieties of corn under different conditions of soil and climate in every case gave increased yields due wholly to a separation of the kernels planted in each hill.

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FARMERS' BULLETINS.

Bulletins in this list will be sent free, so long as the supply lasts, to any resident of the United States, on application to his **Senator, Representative, or Delegate in Congress,** or to the Secretary of Agriculture, Washington, D. C. Because of the limited supply, applicants are urged to select only a few numbers, choosing those which are of special interest to them. Residents of foreign countries should apply to the Superintendent of Documents, Government Printing Office, Washington, D. C., who has these bulletins for sale. Price 5 cents each to Canada, Cuba, and Mexico; 6 cents to other foreign countries. The bulletins entitled "Experiment Station Work" give briefly the results of experiments performed by the State experiment stations.

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383. How to Destroy English Sparrows.
384. Experiment Station Work—LV.
385. Boys' and Girls' Agricultural Clubs.
386. Potato Culture on Irrigated Farms of the West.
387. The Preservative Treatment of Farm Timbers.
388. Experiment Station Work—LVI.
389. Bread and Bread Making.
390. Pheasant Raising in the United States.
391. Economical Use of Meat in the Home.
392. Irrigation of Sugar Beets.
393. Habit-forming Agents.
394. The Use of Windmills in Irrigation in the Semiarid West.
395. Sixty-day and Kherson Oats.
396. The Muskrat.
397. Bees.
398. Farm Practice in the Use of Commercial Fertilizers in the South Atlantic States.
399. Irrigation of Grain.

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